# United States Patent [19]

**Haffer et al.**

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[54] **LIFT JACK RETENTION BRACKET**


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[73] Assignee: **Towmotor Corporation**, Mentor, Ohio



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[51] **Int. Cl.**[3] ..... **B66B 9/20**

[52] **U.S. Cl.** ..... **187/9 E**; 187/1 R; 248/635

[58] **Field of Search** ..... 187/9 E, 9 R, 1 R; 248/632, 634, 635



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[57] **ABSTRACT**

A lift mast for industrial trucks includes a stationary upright having a movable upright mounted thereon and a lift jack interconnected between the uprights. A bracket member is secured to a cylinder of the lift jack and is further secured to the stationary upright along with at least one elastomeric bushing that will allow the cylinder to move slightly relative to the stationary upright.


**4 Claims, 6 Drawing Figures**

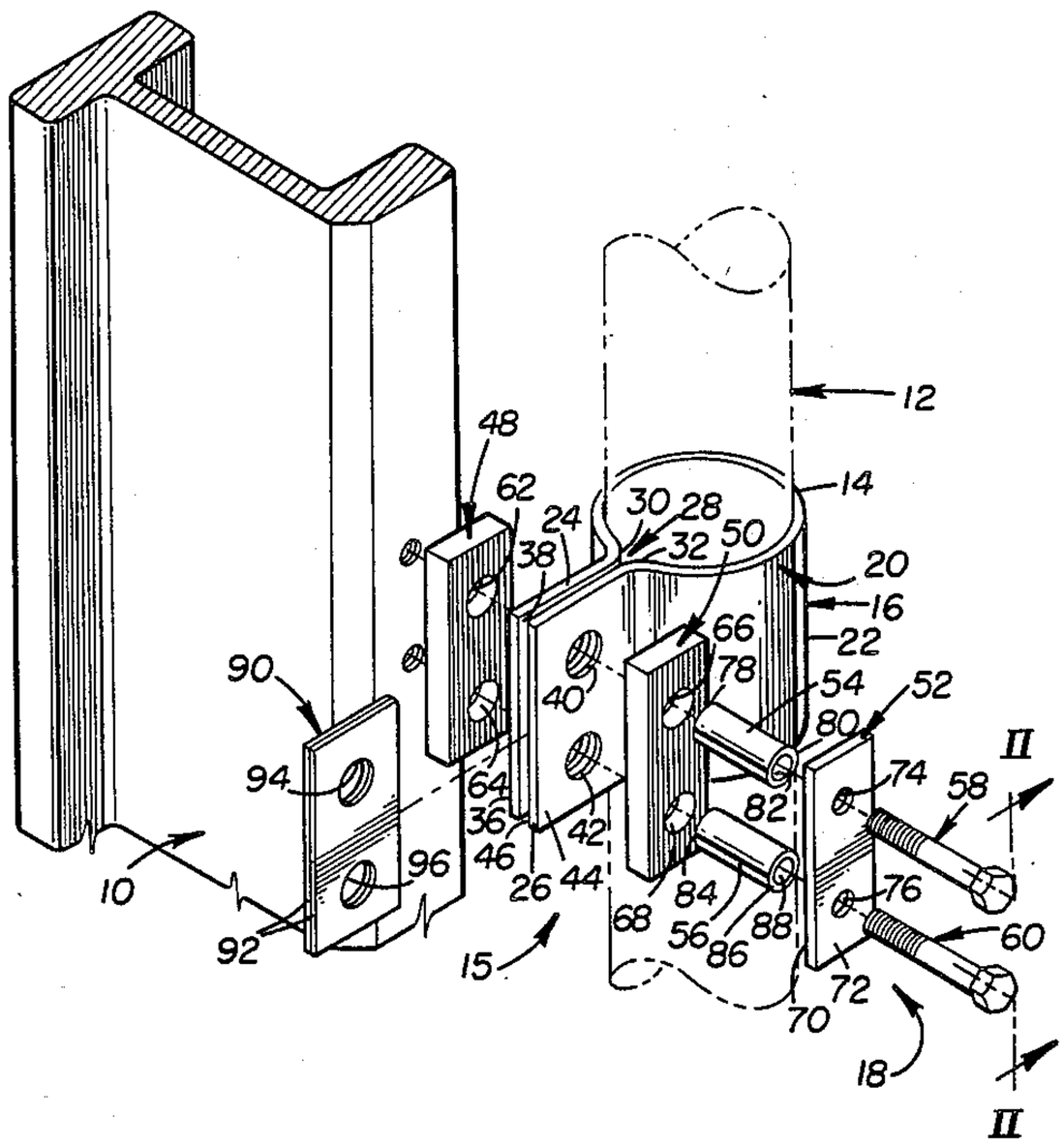

FIGURE 1

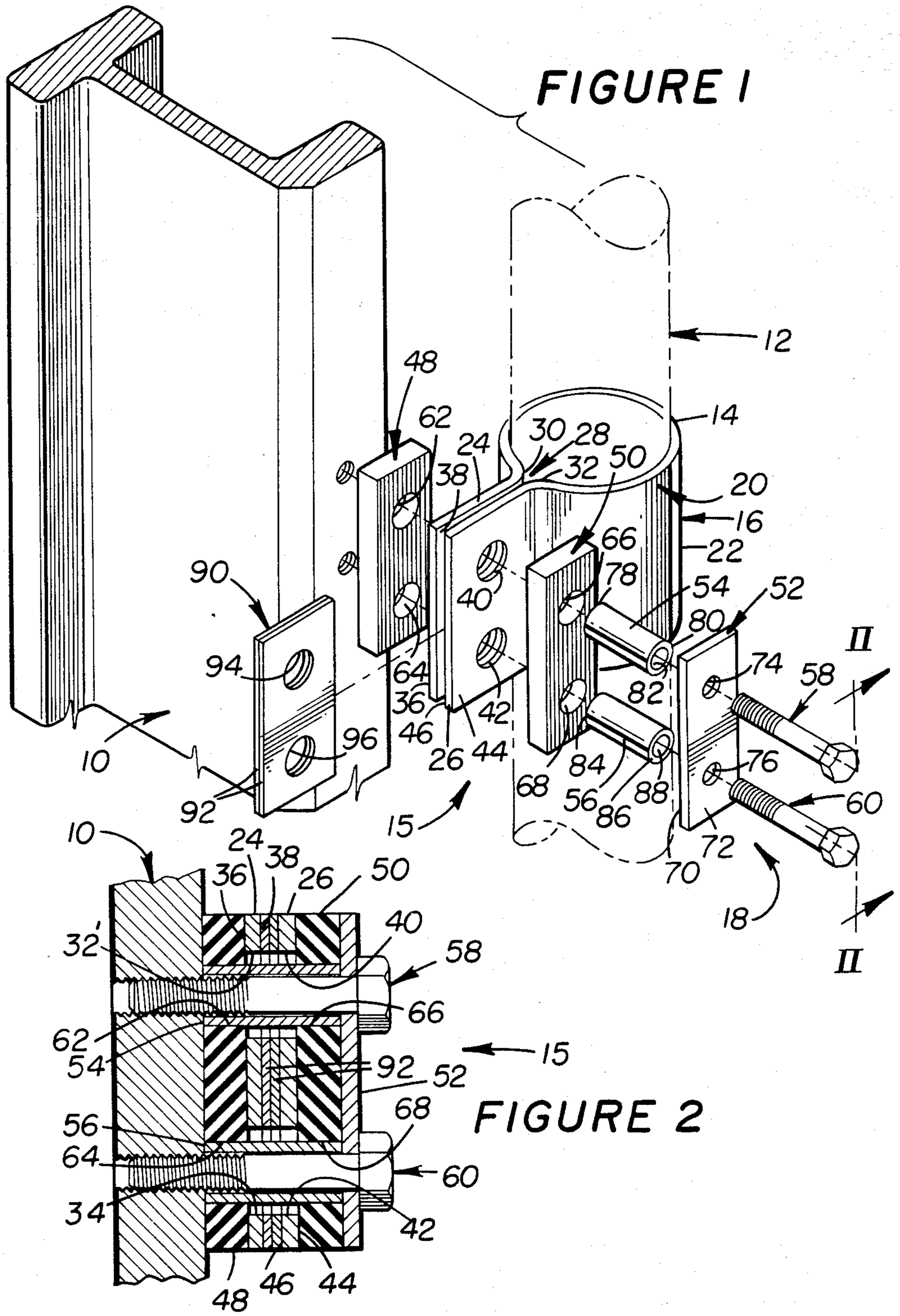


FIGURE 2

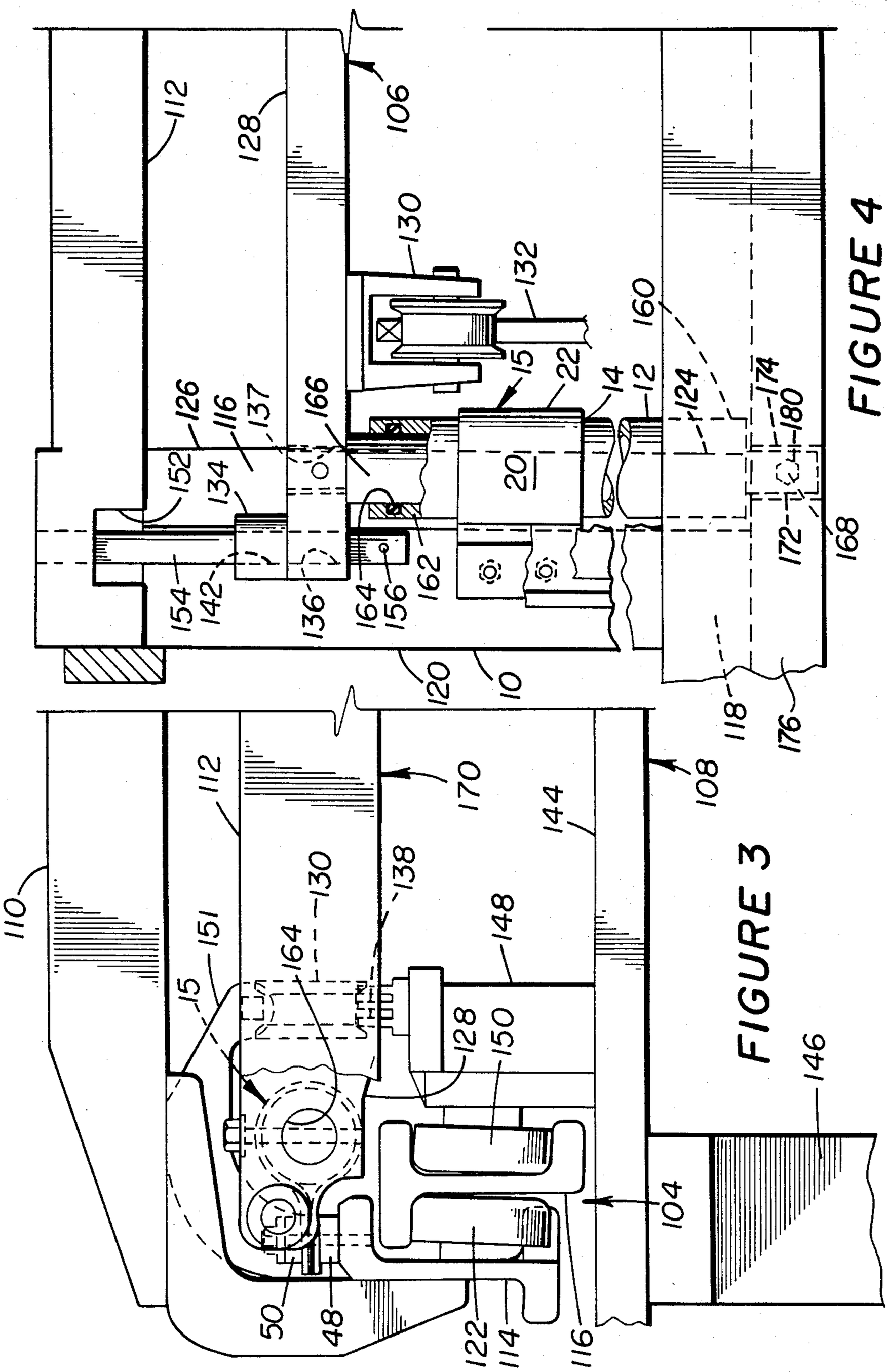


FIGURE 4

FIGURE 3

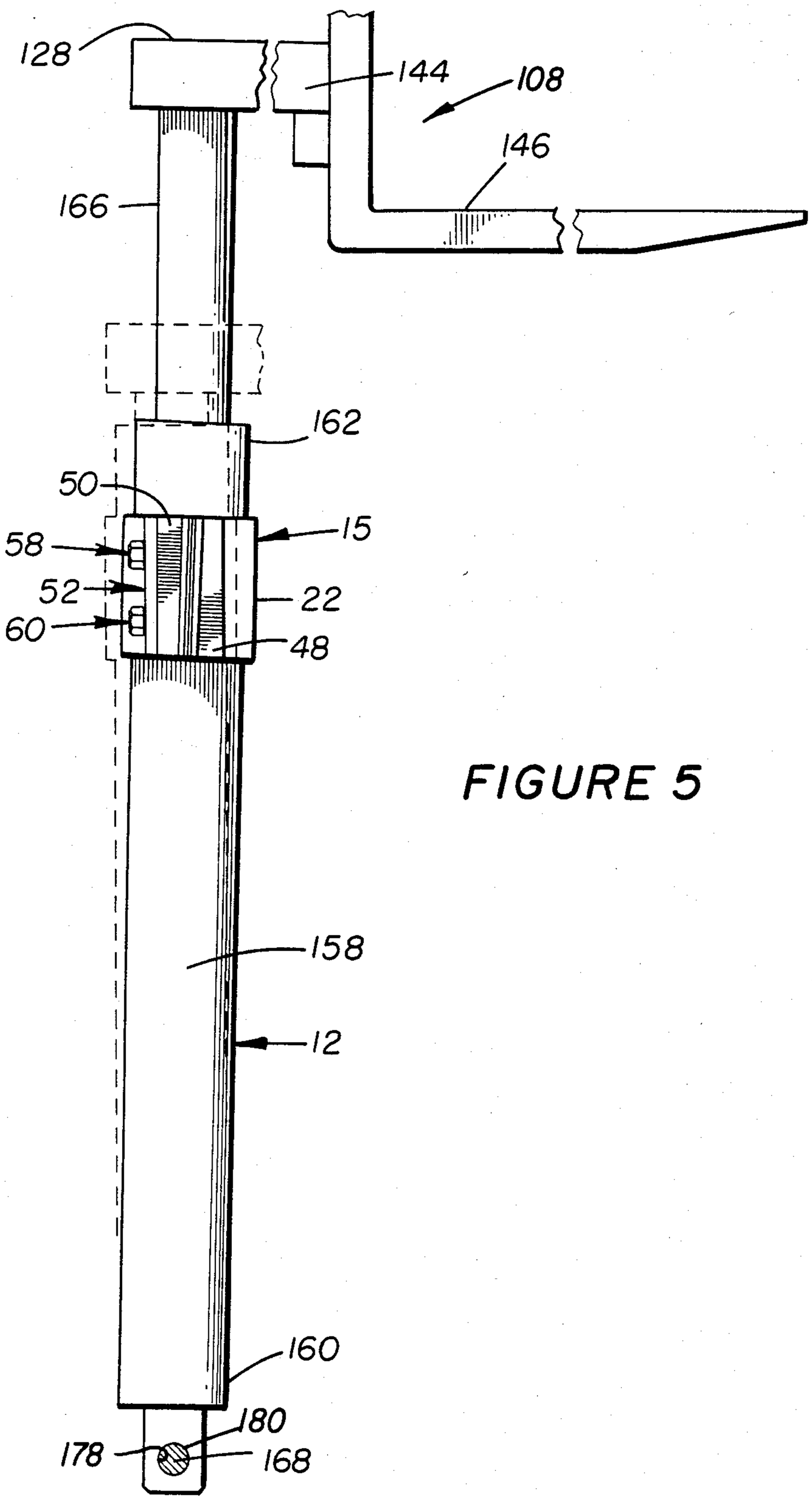


FIGURE 5

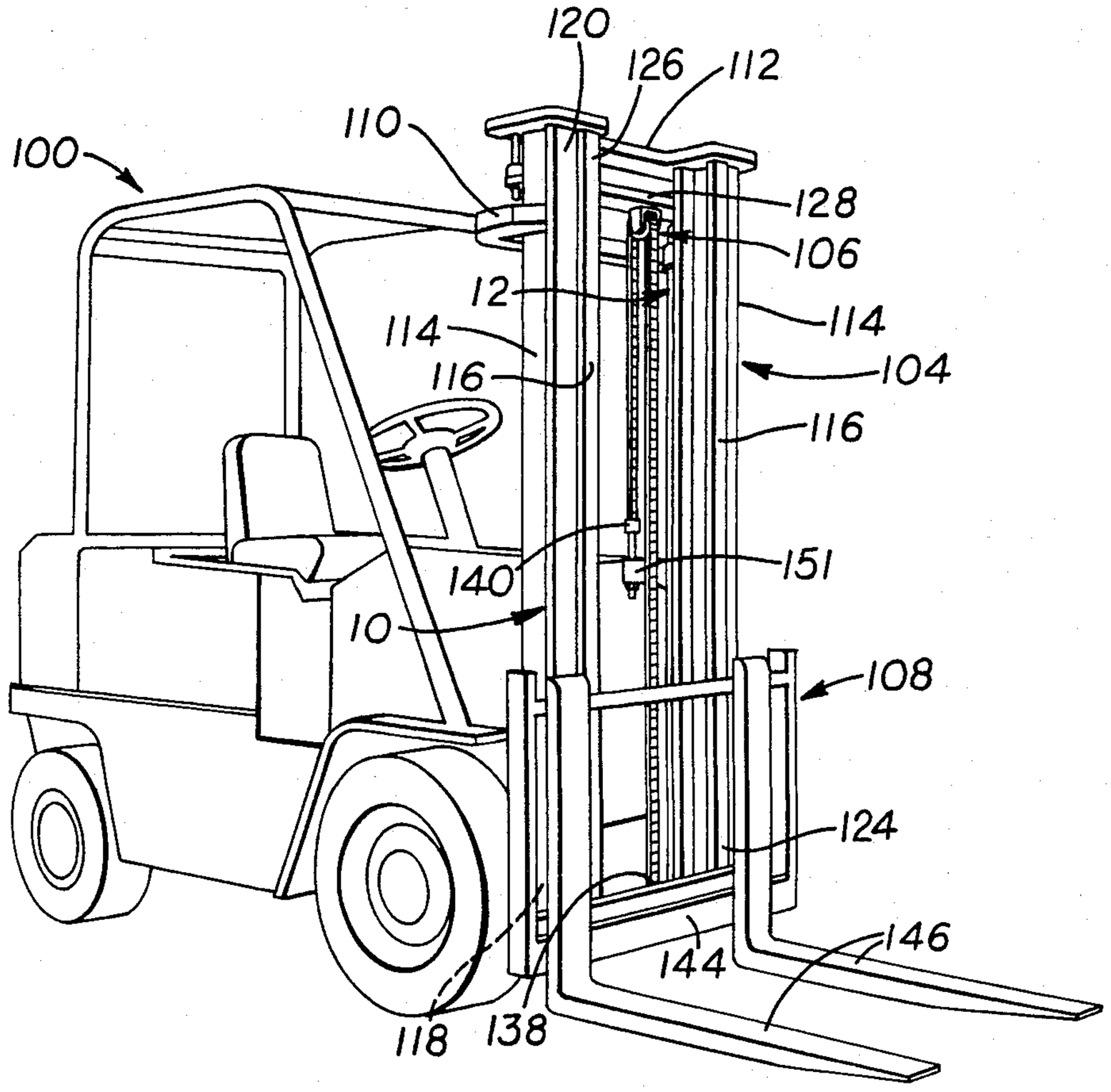
120
126
112
110
100
128
106
12
114
114
116
104
116
140
151
10
108
124
146
144
118
138

FIGURE 6

# LIFT JACK RETENTION BRACKET

## DESCRIPTION

1. Technical Field

The present invention relates generally to a lift mast, and, more particularly, to a lift jack retention bracket for allowing relative movement of a lift jack with respect to a stationary upright of the lift mast when the jack is in an extended load carrying position.

2. Background Art

A known lift mast for supporting a load bearing carriage includes a stationary upright, a movable upright supported by the stationary upright, and a lift jack having a cylinder from which a rod is axially extendable, the lift jack being adapted to act in certain circumstances, between the stationary upright and the movable upright. A sheave of a chain sheave assembly can be mounted to, generally, the rod of the lift jack and the chain can be attached at one end to the carriage and at the other end to a stationary structure such as the stationary upright. Such an assembly can then serve for lifting the carriage. In one particularly useful structure, after the carriage has been raised through a selected free lift distance, the chain sheave assembly engages a lateral cross member affixed to each movable upright. The free lift distance is provided for raising the carriage off a floor without extending the lift mast to allow operation of the lift truck in areas of low overhead clearance. After engagement of the chain sheave assembly with the lateral cross member, further extension of the rod raises the movable upright for providing support for and further elevation of the carriage.

A problem associated with the lift mast arises when the lift mast is being extended during a load carrying operation. The carriage, having a pair of forks horizontally extending forward of the lift mast for carrying the load, develops a moment or torque about the movable upright which is, in turn, displaced from a colinear alignment with the stationary upright. The loss of colinear alignment further displaces the rod of the lift jack from coaxial alignment with the cylinder. A bearing and a hydraulic seal, disposed between the rod and the cylinder, are subject to stress and undue wear when the rod is so displaced.

This problem was recognized by Ulinski (U.S. Pat. No. 3,289,791, issued Dec. 6, 1966) who provided a spherical hydraulic seal pivotably mounted in a rod end portion of the cylinder. A bore through the seal received the rod. Clearance was provided between the rod and cylinder. As the rod was displaced from coaxial alignment with the cylinder, the seal pivoted to minimize stress and wear thereon. Although the spherical hydraulic seal provided by Ulinski is not subject to undue stress and wear, it does require a specially designed rod end portion of the cylinder to accept such a seal. As discussed in the Ulinski patent, others developed special mountings for the cylinder which would permit lateral movement thereof. However, the special mountings have not been widely accepted as it is common practice in the art to fix the cylinder to the stationary upright by welding or other more convenient means.

The present invention is directed to overcoming one or more of the problems as set forth above.



## DISCLOSURE OF THE INVENTION

In one aspect of the present invention, a lift jack retention bracket includes means for engaging a rod end portion of a cylinder of a lift jack and means for resiliently mounting the engaging means to a stationary upright of a lift mast for allowing the cylinder to move in response to a moment exerted on a movable upright of the lift mast upon extension of an extensible rod of the lift jack when extending the lift mast.

The resiliently mounting means bears the stress induced by the moment or torque applied to the rod of the lift jack by allowing the cylinder to move relative to the stationary upright and maintain coaxial alignment of the rod and cylinder. The lift jack need not have specially constructed hydraulic seals.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an exploded view of an embodiment of a lift jack retention bracket according to the principles of the present invention;

FIG. **2** is an assembled cross sectional view taken along line **2**—**2** of FIG. **1**;

FIG. **3** is a partial top plan view of a lift mast, broken away;

FIG. **4** is a rear elevational view, partially in cross section, partially broken away, of the mast assembly of FIG. **3**;

FIG. **5** is a side elevational view, partially broken away, showing the embodiment of the lift jack retention bracket of FIG. **1** and a lift jack of the lift mast of FIGS. **3** and **4** in an elevated position; and

FIG. **6** is a front-side isometric view of a lift truck embodying this invention.

## BEST MODE OF CARRYING OUT THE INVENTION

Referring to FIGS. **1** and **2**, there is shown a frame member **10**, a hydraulic lift jack **12** having an axial portion **14** thereof, and a lift jack retention bracket **15** according to the principles of the present invention. As hereinafter described, frame member **10** preferably is a fixed mast upright wherein lift jack **12** is spaced from such upright and arranged generally parallel thereto.

Lift jack retention bracket **15** includes means **16** for engaging axial portion **14** and means **18** for resiliently mounting engaging means **16** to frame member **10** and, as hereinafter described, for allowing movement of lift jack **12** relative to frame member **10** at the connection of lift jack **12** to frame member **10**.

Engaging means **16** includes a unitary bracket member **20** having a generally cylindrical portion **22**, a first planar portion or flange **24**, and a second planar portion or flange **26**, each planar portion **24** and **26** extending radially outward from cylindrical portion **22** in overlying relationship. The planar portions or flanges are positioned in close proximity to frame member **10**, hereinafter also termed a stationary upright **114**.

Cylindrical portion **22** receiving and clamping a cylinder **158** of the jack therein, includes an axial slot **28** defining a first edge **30** and a second edge **32**, first planar portion **24** being disposed along edge **30**, second planar portion **26** being disposed along second edge **32**. Axial portion **14** is received within cylindrical portion **22**.

First planar portion **24** includes a first aperture **32'**, a second aperture **34**, a first side **36** and a second side **38**. Second planar portion **26** includes a first aperture **40**, a second aperture **42**, a first side **44** and a second side **46**.

Second sides **38** and **46** are in a facing relationship to each other.

Mounting means **18** includes an oblong first elastomeric bushing **48**, an oblong second elastomeric bushing **50**, a generally rectangular plate **52**, a first cylindrical spacer **54**, a second cylindrical spacer **56**, a first bolt **58** and a second bolt **60**.

First bushing **48** has a first opening **62**, a second opening **64**, each opening **62** and **64** disposed therethrough. Second bushing **50** has a first opening **66** and a second opening **68**, each opening **66** and **68** disposed therethrough. Plate **52** has a first face **70**, a second face **72**, a first hole **74** and a second hole **76**. First spacer **54** has a first edge **78**, a second edge **80** and an axial bore **82**. Second spacer **56** has a first edge **84**, a second edge **86** and an axial bore **88**.

Mounting means **18** may further include shim means **90**, such as one or more generally rectangular shims **92** having a first opening **94** and a second opening **96**, for adjusting the diameter of cylindrical portion **22** to receive axial portion **14**.

First bushing **48** is disposed intermediate frame member **10** and first side **36** of planar portion **24**. Second bushing **50** is disposed intermediate first side **44** of planar portion **26** and first side **70** of plate **52**. Shims **92** may be positioned between the facing second sides **38** and **46** of planar portions **24** and **26**, respectively, for adjusting the diameter of cylindrical portion **22** to receive axial portion **14**. First opening **62** of first bushing **48**, first aperture **32'** of planar portion **24**, first opening **94** of shim **92**, first aperture **40** of second planar portion **26** and first opening **66** of second bushing **50** are aligned and are each dimensioned to receive first spacer **54** in frictional engagement except for opening **96** and first apertures **32'** and **40** which have a diameter substantially larger than first spacer **54**. Second opening **64** of first bushing **48**, second aperture **34** of planar portion **24**, second opening **96** of shim **92**, second aperture **42** of second planar portion **26** and second opening **68** of second bushing **50** are aligned and are each dimensioned to receive second spacer **56** in frictional engagement except for opening **96** and second apertures **34** and **42** which have a diameter substantially larger than second spacer **56**.

First spacer **54** is positioned between frame member **10** and first face **70** of plate **52**. First edge **78** abuts frame member **10** and second edge **80** abuts first face **70**. Axial bore **82** and opening **74** are aligned with each other and are each dimensioned to receive bolt **58**. Bolt **58** is threadedly engaged to frame member **10**.

Second spacer **56** is positioned between frame member **10** and first face **70** of plate **52**. First edge **84** abuts frame member **10** and second edge **86** abuts first face **70**. Axial bore **88** and opening **76** are aligned with each other and are each dimensioned to receive bolt **60**. Bolt **60** is threadedly engaged to frame member **10**. Bolts **58** and **60** secure plate **52** and first and second spacers **54** and **56** to frame member **10**, first and second bushings **48** and **50** being compressed.

Referring now to FIGS. **3**, **4** and **5**, there is shown a lift mast **104** of frame member **10**, a chain sheave assembly **106**, a carriage assembly **108** movably mounted on lift mast **104**, a lateral tie bar **110** for bracing lift mast **104**, and a lateral cross member **112** engageable with chain sheave assembly **106**. It should be noted that FIGS. **3** and **4** show only one-half of a mast assembly, the broken away elements not shown being identical in mirror image.

Lift mast **104** is particularly adapted for use on an otherwise standard lift truck **100** (FIG. **6**) and includes a stationary upright **114** and a movable upright **116**. Stationary upright **114** has a first end portion **118**, a second end portion **120** and a roller **122**. Movable upright **116** has a first end portion **124** and a second end portion **126**, and is movably supported by roller **122** within stationary upright **114**. Tie bar **110** is fixed, such as by welding, to second end portion **120** of stationary upright **114**. Cross member **112** is fixed to second end portion **126** of each movable upright **116**. In a lowered position, first end portions **118** and **124** of stationary upright **114** and movable upright **116**, respectively, are spaced adjacent each other. In a raised position, first end portion **124** of movable upright **116** is spaced adjacent second end portion **120** of stationary upright **114**.

Chain sheave assembly **106** includes a generally elongated member **128**, a pulley assembly **130** mounted to an underside of elongated member **128**, a chain **132**, and a cylindrical bushing **134**. Elongated member **128** has a first hole **136** and a second hole **137**.

Chain **132** has a first end **138** and a second end **140**, chain **132** being carried by pulley assembly **130**. Cylindrical pin **134**, having an axial bore **142**, extends upwardly from an end of elongated member **128**. First hole **136** is in communication with axial bore **142**. Second hole **137** is spaced parallel from first hole **136**.

Carriage assembly **108** (FIG. **3**, **5** and **6**) includes a generally rectangular back rest **144**, a fork **146** extending forwardly from back rest **144** for carrying a pallet or load, a mounting member **148** extending rearwardly from back rest **144**, and a roller **150**. Carriage assembly **108** is movably supported by roller **150** within movable upright **116**. First end portion **138** of each chain **132** is secured, in a conventional manner, to mounting member **148**. Second end **140** of each chain **132** is secured to stationary upright **114**. Stationary upright **114**, may have a generally arcuate member **151** to which second end **140** of chain **132** is secured.

Cross member **112** (FIG. **4**) includes a cylindrical recess **152** and a pulldown rod **154**, pulldown rod **154** coaxially extending downwardly from recess **152**. Recess **152** is dimensioned to receive cylindrical bushing **134**. Pulldown rod **154** is dimensioned to be received in linear slidable engagement within first hole **136** and axial bore **142**. Pulldown rod **154** has an axial projection **156** disposed at a lower end thereof.

Lift jack **12** (FIGS. **4** and **5**) includes a cylinder **158** having a head end portion **160** and a rod end portion **162**, a rod seal **164** disposed within rod end portion **162**, and an extensible rod **166** in sealingly slidable engagement with seal **164** and coaxially extendable from cylinder **158**. Means **168** for pivotally connecting head end portion **160** adjacent first end portion **118** of stationary upright **114** is provided. A free end of extensible rod **166** is received within second hole **137** of elongated member **128** and secured thereto. Lift jack **12** is disposed between lift mast **104** and arcuate member **151**. Rod end portion **162** is attached to second end portion **120** of stationary upright **114** by retention bracket **15** as hereinabove described with respect to frame member **10**, frame member **10** being defined by second end portion **120**, and axial portion **14** being defined by rod end portion **162**. Chain sheave assembly **106** and cross member **112** define means **170** for connecting extensible rod **166** to second end portion **126** of movable upright **116**.

Pivotal connecting means **168** (FIGS. **4** and **5**) includes a shaft **172** extending axially outwardly from

head end portion **160** and being of a reduced diameter therefrom, and a bore **174** dimensioned to receive loosely shaft **172** and to permit pivotal movement of shaft **172** therein. A lower crossmember **176** extends outwardly from first end portion **118** of stationary upright **114** and may include bore **174**. Although not necessary in practicing the present invention, pivotal connecting means **168** may further include a radial opening **178** disposed through shaft **172** and a bolt **180** loosely received through radial opening **178** and being threadedly engaged to lower crossmember **176**.

## Industrial Applicability

The present invention is particularly useful, although not intended as a limitation thereon, in a lift mast of the type commonly affixed to a vehicle such as lift truck **100** of FIG. **6**.

As extensible rod **166** is raised from a fully lowered position, thereby raising sheave assembly **106**, and carriage assembly **108** is raised within movable upright **116**. After sheave assembly **106**, and more particularly elongated member **128** and cylindrical bushings **134** thereof engage cross member **112** (FIG. **4**), movable upright **116** is raised therewith. Movable upright **116** is lowered when, upon lowering sheave assembly **106**, projection **156** of pulldown rod **154** is engaged by the lower surface of elongated member **128**. The distance that carriage assembly **108** is raised from a fully lowered position until elongated member **128** engages cross member **112** is defined as a free lift distance. Above the free lift distance carriage assembly **108** moves from the first end portion **124** to the second end portion **126** of movable upright **116** at twice the rate of the elevation of movable upright **116** within stationary upright **114**.

As best shown in FIG. **5**, when extensible rods **166** are extended, thereby raising carriage assembly **108** as hereinabove described toward second end portion **126** of movable upright **116**, a load carried on forks **146** will exert a moment, maximized at full elevation, upon movable upright **116** at second end portion **126** thereof. This moment will displace movable upright **116** from parallel alignment with stationary upright **114**. This moment is further transferred to extensible rod **166** by connecting means **170**. Maintaining coaxial alignment of extensible rod **166** to cylinder **158** is necessary to prevent undue wear and stress on seal **164**.

The moment acting on extensible rod **166** may be considered as the net of two linear components of force, one component acting axially along rod **166** (thus lift jack **12**) and the other component acting radially to rod **166**. The axial component is absorbed primarily by pivotally connecting means **168**. The radial component is absorbed primarily by bushings **48** and **50** as lift jack **12** pivots about connecting means **168**. As a result, undue wear of rod seal **164** and rod **166** is minimized.

Other aspects, objects and advantages of this invention can be obtained from a study of the drawings, the disclosure, and the appended claims.

We claim:

**1**. A lift mast (**104**) adapted for mounting on a lift truck (**100**) comprising

a statutory upright (**114**),

a movable upright (**116**), movably mounted on said stationary upright (**114**),

at least one lift jack (**12**) interconnected between said stationary upright (**114**) and said movable upright (**116**), said lift jack (**12**) having a cylinder (**158**) and an extensible rod (**166**) reciprocally mounted in said cylinder (**158**), and

means (**16,18**) for resiliently mounting said cylinder (**158**) on said stationary upright (**114**) to allow said cylinder (**158**) to move slightly relative to said stationary upright (**114**) in response to the imposition of a moment on an upper end of said movable upright (**116**), said means (**16,18**) including a unitary bracket member (**20**) attached between said cylinder (**152**) and said stationary upright (**114**), said bracket member (**20**) including a cylindrical portion (**22**) clamped about the upper end of said cylinder (**158**) and a pair of overlying flanges (**14,26**) extending radially outwardly from said cylindrical portion (**22**) and positioned in close proximity to said stationary upright (**114**), at least one elastomeric bushing (**48**) disposed and compressed between said flanges (**24,26**) and said stationary upright (**114**) and bolt means (**58,60**) extending through said flanges (**24,126**) and said bushing (**48**) for releasably attaching them to said stationary upright (**114**).

**2**. The lift mast (**104**) of claim **1** wherein said means (**16,18**) further includes a second elastomeric bushing (**50**) disposed on an outer side of said flanges (**24,26**) and a clamping plate (**52**) disposed on an outer side of said second elastomeric bushing (**50**), said bolt means (**58, 60**) extending sequentially through said plate (**52**), said second elastomeric bushing (**50**), said flanges (**24,26**) and said first elastomeric bushing (**48**).

**3**. The lift mast (**104**) of claim **2** wherein said means (**16,18**) further includes spacer means (**54,56**) extending through said flanges (**24,26**) and each of said first and second elastomeric bushings (**48,50**) for precisely positioning said plate (**52**) relative to said stationary upright (**114**) upon tightening of said bolt means (**58,60**).

**4**. A lift mast (**104**) adapted for mounting on a lift truck (**100**) comprising

a stationary upright (**114**),

a movable upright (**116**), movably mounted on said stationary upright (**114**),

at least one lift jack (**12**) interconnected between said stationary upright (**114**) and said movable upright (**116**), said lift jack (**12**) having a cylinder (**158**) and an extensible rod (**166**) reciprocally mounted in said cylinder (**158**), and

means (**16,18**) for resiliently mounting said cylinder (**158**) on said stationary upright (**114**) to allow said cylinder (**158**) to move slightly relative to said stationary upright (**114**) in response to the imposition of a moment on an upper end of said movable upright (**116**), said means (**16,18**) including a bracket member (**20**) attached between said cylinder (**152**) and said stationary upright (**114**), said bracket member (**20**) including a cylindrical portion (**22**) clamped about the upper end of said cylinder (**158**) and a pair of overlying flanges (**24,26**) extending radially outwardly from said cylindrical portion (**22**) and secured to said stationary upright (**114**), a first elastomeric bushing (**48**) disposed between said flanges (**24,26**) and said stationary upright (**114**), a second elastomeric burshing (**50**) disposed on an outerside of said flanges (**24,26**), a clamping plate (**52**) disposed on an outer side of said second elastomeric bushing (**50**), and bolt means (**58,60**) extending sequentially through said plate (**52**), said second elastomeric bushing (**50**), said flanges (**24,26**) and said first elastomeric bushing (**48**) for releasably attaching them to said stationary upright (**114**).

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